CHEVRON RICHMOND REFINERY
TENTATIVE ORDER AND NPDES PERMIT

REQUEST FOR *COMPLIANCE SCHEDULE* AND DEMONSTRATION OF INFEASIBILITY TO ACHIEVE IMMEDIATE COMPLIANCE WITH CALCULATED EFFLUENT LIMITATION FOR

Selenium

Executive Summary

Pursuant to discussions with staff and to §2.1 of the SWRCB's *Policy for Implementation of Toxics Standard for Inland Surface Waters, Enclosed Bays, and Estuaries of California* [the "SIP"], Chevron submits as an addendum to its NPDES permit application a request for a compliance schedule and Chevron's documentation that it is infeasible to meet the final limits for selenium proposed in the RWQCB's tentative order.

Infeasibility Demonstration.

In support of its request, Chevron submits the following demonstration that it is infeasible to achieve immediate compliance with 4.31 ug/L AMEL and 7.6 ug/L MDEL for Selenium.

> As defined in the SIP, infeasible means
>
> "not capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors"

In this case, the SIP defines a "reasonable period of time" to be "immediate." Therefore, in cases where, as here, the actions needed to achieve compliance could not be implemented by the permit's effective date, they could not be completed within a reasonable period of time. In addition to this timing factor, possible actions to achieve compliance must be evaluated in light of the defined factors to determine their feasibility.

Staff has calculated a proposed final Water Quality Based effluent of 4.31 ug/L average monthly effluent level (AMEL) and 7.6 ug/L maximum daily effluent level

(MDEL). Chevron's performance history relating to this constituent reflects that Chevron's effluent does not meet this limit. Further, as explained in greater detail below, Chevron has undertaken a variety of efforts to date to reduce its discharge loading as much as possible and cannot achieve immediate compliance with the proposed final limits for the following reasons:

- Source of the contaminant is generally known, as described elsewhere in this document, but we need to develop additional information on the quantity and variability of the principle source(s) before we can develop additional appropriate measures for control.

- We do not currently have a complete understanding of the chemistry, speciation, and fate of the contaminant in our treatment system and need more time to develop this understanding before we design effective measures to improve performance

- If any major projects were to be generated as the result of identifying additional practical treatment or source control technologies, we would have to go through a permitting process and might trigger CEQA and an environmental impact analysis. Permitting and CEQA processes can be very time consuming.

- A detailed program to develop alternative feasibility technologies may be required, as outlined below

Given the efforts to date, it is unclear what additional actions and measures may be necessary to meet that limit. A number of steps will be needed to determine what actions may be necessary and feasible in order to achieve compliance with this limit. Those steps will involve additional studies to evaluate future options, and those studies may demonstrate that new technology or new methods are necessary, appropriate and feasible. For example, Chevron may evaluate options, using criteria such as the following:

- Known, demonstrated technology that is available and has been demonstrated in refineries or related industries;
- Ability to achieve required effluent levels;
- Ability to pilot or demonstrate the technology in Chevron's plant;
- Implementation time for a given technology;
- Feasibility and cost effectiveness.

Certainly, carrying out these steps will be costly and time-consuming and may require additional environmental analyses and permits. In any case, they can not be completed and implemented in time for this permit to go into effect.

For the reasons discussed above, Chevron believes it is infeasibility to achieve immediate compliance with the proposed effluent limit for SELENIUM.

Selenium is a CWA §303(d)-listed constituent. Its presence in the refinery wastewater occurs at very low levels (typically <50 ug/L in the effluent). Selenium is a natural element, a micronutrient necessary and is a trace constituent in crude oil, in which it may be present in several different chemical forms with different physical properties.

Because selenium is a §303(d)-listed constituent, ultimately a final limit for selenium will be based on a TMDL and a waste load allocation (WLA) will be developed for the refinery. Notwithstanding that the TMDL has not been completed, the permit writer has proposed a WQBEL for selenium in the tentative order of 4.31 ug/L average monthly effluent level (AMEL) and 7.6 ug/L maximum daily effluent level (MDEL).

In the following sections Chevron will document:

A. Diligent efforts made to quantify pollutant levels in the discharge and the sources of the pollutant in the waste stream, and the results of those efforts;

B. Source control and/or pollution minimization efforts currently underway or completed;

C. A proposed schedule for additional or future source control measures, pollution minimization actions, or waste treatment;

D. A demonstration that the proposed schedule is as short as practicable.

A. Pollutant Levels and Sources.

Final Limits. The proposed WQBEL final limits for selenium are:
AMEL: 4.3 ug/L
MDEL: 7.6 ug/L

Effluent data:
Selenium is monitored monthly in refinery effluent. Table 1.0 summarizes selenium data for the last three years. These data show:

- The average effluent selenium was 13.4 ug/L
- The maximum observed value was 39.7 ug/L
- The estimated 99.87%tile of selenium data for the life of the permit is 56.4 ug/L, assuming a log-normal distribution.

These data demonstrate that the final limits cannot currently be met.

Sources:
Selenium is routinely detected in the Refinery's wastewater discharge (Waste 001) at levels in compliance with the NPDES permit. Selenium enters the Refinery as a naturally occurring component of crude oil. As a process of crude oil refining, selenium tracks sulfur through various processes, and concentrates in both the sour water concentrators and sour water strippers. The chemistry of selenium is similar to that of sulfur and selenium in sour water and refinery effluents occurs as selenide, selenite, selenate, and seleno-cyanate, the compounds parallel to sulfide, sulfite, sulfate, and thiocyanate.

B. Past and Current Pollution Minimization Efforts:

During 1988 and 1989 as a condition of the NPDES permit, selenium sources to the Effluent Treatment System were reviewed and control strategies developed. The study indicated that selenium enters the refinery as a naturally occurring component of crude oil. As the crude oil is processed to remove sulfur as hydrogen sulfide, selenium is likewise converted to hydrogen selenide and tracks sulfur through the sour gas system. The sour gas containing hydrogen selenide is then dissolved in refining processes utilizing wash water and stripping steam and enters the Refinery's sour water system. The sour water system consists of sour water storage tanks, sour water concentrators and sour water strippers. Discharges of wastewater containing selenium to the Effluent Treatment System occur from the sour water concentrators (FCC and LSFO sour water concentrators) and sour water strippers (8 Plant and 18 Plant), and are referred to as "stripped sour water".

Several control strategies were investigated, including treatment technologies and source controls. Treatment technologies focused on stripped sour water and included ion exchange, iron co-precipitation and carbon adsorption. The most promising technology for stripped sour water, ion exchange, was piloted. Results were mixed (25-90% reduction depending on sources) and fouling of the resin was a significant problem. The cost for treatment was determined to not be cost effective, and control strategies were focused on source control and reuse opportunities. Control strategies were reviewed by the RWQCB and Chevron received its concurrence. Source control strategies included:

- the reuse of stripped sour water as flare seal water,
- replacing fresh water with stripped sour water for pump seal flush and reflux to sour water stripper columns, and
- re-routing stripped sour water from both sour water strippers to process plants for wash water use.

Implementation of these efforts was estimated to reduce selenium discharges in the Refinery effluent by 10%.

During 1993 and 1995, the Chevron Richmond Refinery participated in a Selenium Removal Technology Study through the Western States Petroleum Association (WSPA). This study included four main components, selenium speciation, iron process treatability, ion exchange and metal oxide adsorption process treatability, and biological process treatability. Several independent studies by other refineries were also assessed as part of this study. Lastly, WSPA treatability testing studies were used in the development of design criteria, which in turn were used to prepare conceptual flow schemes and cost estimates for eight potential process alternatives as applied to a "typical" refinery. The WSPA recommended technology is iron co-precipitation. In order for this process to be successful, selenium compounds have to be in the selinite form. The predominant selenium form in the Chevron wastewater stream is not selinite, and is therefore far less conducive to treatment utilizing a co-precipitation process. Interim and final reports on the Selenium Removal Technology Study were submitted to the RWQCB.

Current Pollution Minimization Efforts: Efforts are made to control selenium levels entering the Refinery's Effluent Treatment System by management controls at the sour water processing plants (Plants 8 and 18); through both operational and maintenance controls. These control methods are proprietary and have been previously reported to the RWQCB under a trade secret business confidential cloak pursuant to §6254.7(d) of the California Government Code

Current Reduction Practices: The Richmond Refinery Water Enhancement Wetlands (RRWEW) is effective in reducing selenium concentrations in the Refinery's wastewater discharge. The wetland receives treated wastewater from the Refinery's aerated lagoon (Bioreactor) and is constructed of three 30-acre passes. In general, total selenium concentrations decrease as water flows through the wetland; inlet concentrations of 20-30 ug/l (parts per billion) are substantially reduced as they flow through the wetland treatment areas.

C. Pollution Minimization Proposals and Schedule

The Discharger agrees to participate in the development of a TMDL for Selenium. The Discharger will give a written annual update to the RWQCB staff to document the progress made towards development of the TMDL.

Chevron will conduct any source control or pollution minimization studies in accordance with California Water Code §13263.3 and §2.1 of the SIP. In accordance with CWC §13263.3, this work will proceed outside of the NPDES permit itself, and will not be a condition of this permit.

D. Demonstration that Compliance Schedule is as Short as Possible

The Discharger and the RWQCB staff both recognize that the development of TMDLs will likely take longer than the permit term. The schedule for adoption of the TMDL determines the length of the compliance schedule and, on that

basis, is as short as possible. The Discharger agrees to work with the staff to again evaluate the length of the compliance schedule during consideration of the Discharger's next NPDES permit.

SELENIUM Infeasibility Evaluation Data, May 2001
Chevron Richmond Refinery
June 1995 - October 2000 Table 1.0

Selenium							
92-111					(lb/d)	Monthly Avg.	
Conc. Limit, ug/l	Date	Conc (mg/l)	Conc (ug/l)	Mass (lb/d)	Annual Avg.	Loading Limit	Monthly Avg.
50	06/01/1995	0.022	22	0.73	1.19	2.38	
50	06/07/1995	0.025	25	0.85	1.20	2.38	
50	06/15/1995	0.021	21	0.65	1.20	2.38	
50	06/21/1995	0.019	19	0.77	1.21	2.38	
50	06/29/1995	0.013	13	0.31	1.20	2.38	1.20
50	07/06/1995	0.016	16	0.79	1.23	2.38	
50	07/12/1995	0.018	18	0.54	1.21	2.38	
50	07/20/1995	0.027	27	1.08	1.23	2.38	
50	07/28/1995	0.028	28	0.81	1.22	2.38	1.22
50	08/03/1995	0.028	28	0.85	1.23	2.38	
50	08/09/1995	0.035	35	1.10	1.23	2.38	
50	08/17/1995	0.027	27	1.27	1.24	2.38	
50	08/24/1995	0.022	22	0.98	1.25	2.38	
50	08/31/1995	0.026	26	1.51	1.25	2.38	1.24
50	09/06/1995	0.025	25	1.22	1.25	2.38	
50	09/15/1995	0.025	25	1.01	1.24	2.38	
50	09/20/1995	0.024	24	1.00	1.23	2.38	
50	09/27/1995	0.010	10	0.45	1.22	2.38	1.24
50	10/05/1995	0.021	21	0.53	1.21	2.38	
50	10/11/1995	0.019	19	0.70	1.19	2.38	
50	10/18/1995	0.040	40	1.22	1.19	2.38	
50	10/28/1995	0.039	39	0.92	1.20	2.38	1.20
50	11/02/1995	0.025	25	0.86	1.20	2.38	
50	11/09/1995	0.024	24	0.74	1.17	2.38	
50	11/17/1995	0.015	15	0.57	1.13	2.38	
50	11/22/1995	0.011	11	0.41	1.12	2.38	
50	11/30/1995	0.012	12	0.44	1.10	2.38	1.14
50	12/06/1995	0.028	28	1.01	1.10	2.38	
50	12/14/1995	0.019	19	2.14	1.11	2.38	
50	12/22/1995	0.024	24	2.30	1.14	2.38	
50	12/28/1995	0.016	16	1.36	1.14	2.38	1.12
50	01/04/1996	0.009	9	0.78	1.11	2.38	
50	01/10/1996	0.009	9	0.71	1.07	2.38	
50	01/19/1996	0.019	19	2.01	1.06	2.38	
50	01/25/1996	0.019	19	1.41	1.03	2.38	1.07
50	02/02/1996	0.020	20	2.59	1.05	2.38	
50	02/07/1996	0.017	17	2.63	1.05	2.38	
50	02/15/1996	0.007	7	0.45	1.04	2.38	
50	02/22/1996	0.014	14	1.88	1.04	2.38	
50	02/28/1996	0.016	16	1.36	1.05	2.38	1.05
50	03/07/1996	0.011	11	1.11	1.04	2.38	
50	03/15/1996	0.011	11	1.02	1.03	2.38	
50	03/20/1996	0.009	9	0.43	1.01	2.38	
50	03/29/1996	0.034	34	1.36	1.02	2.38	1.03
50	04/03/1996	0.013	13	0.38	1.01	2.38	
50	04/11/1996	0.015	15	0.73	1.01	2.38	
50	04/18/1996	0.023	23	1.01	1.01	2.38	
50	04/26/1996	0.021	21	0.69	1.01	2.38	1.01
50	05/02/1996	0.012	12	0.57	1.00	2.38	
50	05/09/1996	0.026	26	0.92	1.00	2.38	
50	05/15/1996	0.018	18	0.81	1.01	2.38	
50	05/24/1996	0.020	20	1.11	1.02	2.38	
50	05/30/1996	0.030	30	1.40	1.03	2.38	1.01
50	06/06/1996	0.032	32	1.10	1.04	2.38	
50	06/12/1996	0.028	28	0.83	1.04	2.38	
50	06/20/1996	0.026	26	0.72	1.04	2.38	
50	06/26/1996	0.041	41	1.80	1.07	2.38	1.05
50	07/03/1996	0.037	37	1.88	1.09	2.38	
50	07/11/1996	0.044	44	1.26	1.10	2.38	
50	07/17/1996	0.020	20	0.72	1.10	2.38	
50	07/26/1996	0.020	20	0.47	1.09	2.38	1.10
50	08/01/1996	0.015	15	0.69	1.09	2.38	

50	08/08/1996	0.008	8	0.19	1.07	2.38	
50	08/14/1996	0.012	12	0.27	1.05	2.38	
50	08/22/1996	0.016	16	0.27	1.04	2.38	
50	08/29/1996	0.010	10	0.31	1.01	2.38	1.05
50	09/05/1996	0.011	11	0.66	1.00	2.38	
50	09/11/1996	0.012	12	0.08	0.99	2.38	
50	09/19/1996	0.022	22	1.03	0.99	2.38	
50	09/25/1996	0.024	24	0.79	0.99	2.38	0.99
50	10/02/1996	0.016	16	0.60	0.99	2.38	
50	10/10/1996	0.010	10	0.60	0.99	2.38	
50	10/17/1996	0.011	11	0.15	0.97	2.38	
50	10/23/1996	0.008	8	0.28	0.96	2.38	
50	10/31/1996	0.014	14	0.91	0.96	2.38	0.97
50	11/07/1996	0.015	15	0.92	0.96	2.38	
50	11/13/1996	0.019	19	0.56	0.96	2.38	
50	11/21/1996	0.016	16	1.27	0.98	2.38	
50	11/27/1996	0.013	13	0.74	0.99	2.38	0.97
50	12/04/1996	0.026	26	1.59	1.00	2.38	
50	12/12/1996	0.018	18	2.17	1.00	2.38	
50	12/18/1996	0.014	14	1.18	0.98	2.38	
50	12/27/1996	0.017	17	2.53	1.00	2.38	1.00
50	01/08/1997	0.023	23	1.70	1.08	2.38	
50	01/16/1997	0.039	39	2.83	1.10	2.38	
50	01/23/1997	0.033	33	4.38	1.16	2.38	
50	01/31/1997	0.029	29	2.87	1.16	2.38	1.13
50	02/05/1997	0.029	29	2.59	1.16	2.38	
50	02/13/1997	0.032	32	1.67	1.18	2.38	
50	02/21/1997	0.044	44	2.19	1.19	2.38	
50	02/26/1997	0.041	41	2.31	1.21	2.38	1.19
50	03/06/1997	0.036	36	1.16	1.21	2.38	
50	03/14/1997	0.034	34	1.70	1.22	2.38	
50	03/19/1997	0.042	42	1.77	1.25	2.38	
50	03/27/1997	0.039	39	1.32	1.25	2.38	1.23
50	04/04/1997	0.034	34	1.31	1.26	2.38	
50	04/09/1997	0.038	38	1.63	1.28	2.38	
50	04/17/1997	0.033	33	1.13	1.28	2.38	
50	04/25/1997	0.041	41	1.92	1.31	2.38	
50	04/30/1997	0.031	31	1.24	1.32	2.38	1.29
50	05/07/1997	0.029	29	0.96	1.32	2.38	
50	05/15/1997	0.020	20	0.83	1.32	2.38	
50	05/23/1997	0.049	49	2.59	1.35	2.38	
50	05/28/1997	0.037	37	1.87	1.36	2.38	1.34
50	06/05/1997	0.037	37	1.67	1.37	2.38	
50	06/13/1997	0.035	35	1.29	1.38	2.38	
50	06/18/1997	0.031	31	1.47	1.39	2.38	
50	06/26/1997	0.031	31	1.32	1.38	2.38	1.38
50	07/02/1997	0.029	29	1.34	1.37	2.38	
50	07/10/1997	0.029	29	1.03	1.37	2.38	
50	07/18/1997	0.023	23	0.88	1.37	2.38	
50	07/23/1997	0.041	41	1.53	1.39	2.38	
50	07/31/1997	0.036	36	1.79	1.41	2.38	1.38
50	08/06/1997	0.026	26	1.01	1.43	2.38	
50	08/14/1997	0.020	20	0.79	1.44	2.38	
50	08/22/1997	0.023	23	1.26	1.46	2.38	
50	08/27/1997	0.029	29	1.56	1.48	2.38	1.45
50	09/03/1997	0.032	32	1.37	1.50	2.38	
50	09/11/1997	0.032	32	1.28	1.52	2.38	
50	09/19/1997	0.032	32	1.18	1.52	2.38	
50	09/24/1997	0.033	33	1.20	1.53	2.38	1.52
50	10/02/1997	0.032	32	1.58	1.55	2.38	
50	10/10/1997	0.027	27	2.40	1.58	2.38	
50	10/15/1997	0.026	26	1.31	1.61	2.38	
50	10/23/1997	0.022	22	1.15	1.62	2.38	
50	10/31/1997	0.018	18	0.76	1.62	2.38	1.60
50	11/05/1997	0.016	16	0.50	1.61	2.38	
50	11/13/1997	0.024	24	1.80	1.64	2.38	
50	11/21/1997	0.021	21	2.04	1.65	2.38	
50	11/26/1997	0.021	21	3.11	1.70	2.38	1.65
50	12/03/1997	0.014	14	1.40	1.69	2.38	

50	12/11/1997	0.026	26	1.64	1.68	2.38	
50	12/19/1997	0.022	22	2.05	1.70	2.38	
50	12/24/1997	0.022	22	1.06	1.67	2.38	
50	12/31/1997	0.024	24	1.31	1.62	2.38	1.67
50	01/07/1998	0.018	18	1.43	1.61	2.38	
50	01/15/1998	0.013	13	1.84	1.59	2.38	
50	01/23/1998	0.007	7	0.76	1.52	2.38	
50	01/28/1998	0.008	8	0.69	1.48	2.38	1.55
50	02/04/1998	0.013	13	3.13	1.49	2.38	
50	02/04/1998	0.007	7	1.69	1.49	2.38	
50	02/05/1998	0.008	8	1.91	1.50	2.38	
50	02/06/1998	0.008	8	1.61	1.50	2.38	
50	02/07/1998	0.002	2	0.60	1.49	2.38	
50	02/08/1998	0.006	6	1.91	1.50	2.38	
50	02/09/1998	0.006	6	1.55	1.50	2.38	
50	02/10/1998	0.004	4	0.91	1.49	2.38	
50	02/11/1998	0.002	2	0.32	1.47	2.38	
50	02/12/1998	0.002	2	0.38	1.45	2.38	
50	02/17/1998	0.002	2	0.26	1.43	2.38	
50	02/26/1998	0.006	6	0.64	1.42	2.38	1.48
50	03/06/1998	0.00907	9	0.95	1.38	2.38	
50	03/11/1998	0.005	5	0.31	1.36	2.38	
50	03/19/1998	0.00685	7	0.30	1.33	2.38	
50	03/27/1998	0.0264	26	1.53	1.34	2.38	1.35
50	04/01/1998	0.0202	20	1.00	1.33	2.38	
50	04/09/1998	0.00677	7	0.42	1.32	2.38	
50	04/17/1998	0.00958	10	0.54	1.30	2.38	
50	04/22/1998	0.00851	9	0.45	1.28	2.38	
50	04/30/1998	0.0183	18	0.52	1.27	2.38	1.30
50	05/08/1998	0.0141	14	0.39	1.26	2.38	
50	05/15/1998	0.02319	23	1.63	1.27	2.38	
50	05/21/1998	0.01951	20	0.76	1.24	2.38	
50	05/29/1998	0.02011	20	0.78	1.22	2.38	1.25
50	06/03/1998	0.00955	10	0.43	1.20	2.38	
50	06/11/1998	0.0174	17	0.88	1.19	2.38	
50	06/19/1998	0.0199	20	0.76	1.18	2.38	
50	06/24/1998	0.0115	11	0.47	1.17	2.38	1.19
50	07/03/1998	0.01225	12	0.49	1.15	2.38	
50	07/10/1998	0.01344	13	0.57	1.15	2.38	
50	07/15/1998	0.01594	16	0.71	1.14	2.38	
50	07/23/1998	0.02403	24	1.31	1.14	2.38	
50	07/31/1998	0.01781	18	0.64	1.12	2.38	1.14
50	08/05/1998	0.01535	15	0.28	1.11	2.38	
50	08/13/1998	0.01498	15	0.74	1.11	2.38	
50	08/21/1998	0.00883	9	0.33	1.09	2.38	
50	08/26/1998	0.01197	12	0.53	1.07	2.38	1.10
50	09/03/1998	0.02455	25	0.90	1.07	2.38	
50	09/11/1998	0.00791	8	0.22	1.05	2.38	
50	09/16/1998	0.01265	13	0.68	1.04	2.38	
50	09/24/1998	0.01607	16	0.67	1.03	2.38	1.05
50	10/02/1998	0.00736	7	0.38	1.01	2.38	
50	10/07/1998	0.01710	17	0.96	0.99	2.38	
50	10/15/1998	0.01831	18	0.97	0.98	2.38	
50	10/23/1998	0.02340	23	1.74	0.99	2.38	
50	10/28/1998	0.01547	15	0.65	0.99	2.38	0.99
50	11/05/1998	0.01576	16	0.80	1.00	2.38	
50	11/13/1998	0.01672	17	0.91	0.98	2.38	
50	11/18/1998	0.02799	28	1.44	0.97	2.38	
50	11/24/1998	0.03865	39	3.02	0.97	2.38	0.98
50	12/02/1998	0.02750	28	3.59	1.01	2.38	
50	12/10/1998	0.02075	21	1.55	1.00	2.38	
50	12/18/1999	0.02520	25	1.75	1.00	2.38	
50	12/22/1998	0.02474	25	1.18	1.00	2.38	
50	12/30/1999	0.03297	33	2.04	1.01	2.38	1.00
50	01/06/1999	0.03765	38	1.85	1.02	2.38	
50	01/14/1999	0.03155	32	1.09	1.01	2.38	
50	01/19/1999	0.04803	48	3.82	1.06	2.38	
50	01/27/1999	0.04160	42	2.08	1.08	2.38	1.04
50	02/04/1999	0.02806	28	1.26	1.04	2.38	
50	02/12/1999	0.01510	15	1.21	1.03	2.38	

50	02/17/1999	0.01433	14	2.15	1.06	2.38	
50	02/25/1999	0.01082	11	0.90	1.07	2.38	1.05
50	03/02/1999	0.01322	13	1.04	1.07	2.38	
50	03/10/1999	0.01577	16	1.25	1.09	2.38	
50	03/18/1999	0.01284	13	0.89	1.10	2.38	
50	03/26/1999	0.01684	17	1.10	1.09	2.38	
50	03/30/1999	0.01753	18	1.03	1.09	2.38	1.09
50	04/07/1999	0.01589	16	1.15	1.09	2.38	
50	04/15/1999	0.01920	19	1.06	1.10	2.38	
50	04/23/1999	0.00700	7	0.20	1.11	2.38	
50	04/27/1999	0.00853	9	0.38	1.11	2.38	1.10
50	05/05/1999	0.01230	12	0.89	1.12	2.38	
50	05/13/1999	0.01456	15	0.80	1.10	2.38	
50	05/21/1999	0.01933	19	0.55	1.10	2.38	
50	05/26/1999	0.02306	23	0.66	1.10	2.38	1.11
50	06/03/1999	0.01882	19	0.60	1.10	2.38	
50	06/08/1999	0.02180	22	0.75	1.10	2.38	
50	06/17/1999	0.01800	18	0.62	1.09	2.38	
50	06/24/1999	0.01561	16	0.64	1.10	2.38	1.10
50	07/02/1999	0.02020	20	0.63	1.10	2.38	
50	07/07/1999	0.02532	25	0.90	1.11	2.38	
50	07/15/1999	0.01700	17	0.63	1.10	2.38	
50	07/20/1999	0.01637	16	0.59	1.09	2.38	
50	07/28/1999	0.02178	22	0.79	1.09	2.38	1.10
50	08/05/1999	0.01731	17	0.95	1.11	2.38	
50	08/13/1999	0.01988	20	0.93	1.11	2.38	
50	08/17/1999	0.02000	20	0.83	1.12	2.38	
50	08/25/1999	0.01630	16	0.68	1.12	2.38	1.12
50	09/02/1999	0.02125	21	0.70	1.12	2.38	
50	09/10/1999	0.02106	21	0.87	1.13	2.38	
50	09/14/1999	0.02312	23	0.94	1.14	2.38	
50	09/22/1999	0.01807	18	0.59	1.13	2.38	
50	09/30/1999	0.01689	17	0.80	1.13	2.38	1.13
50	10/08/1999	0.01580	16	0.67	1.13	2.38	
50	10/12/1999	0.01997	20	0.83	1.13	2.38	
50	10/20/1999	0.01484	15	0.80	1.13	2.38	
50	10/28/1999	0.00711	7	0.29	1.11	2.38	1.13
50	11/05/1999	0.00984	10	0.60	1.11	2.38	
50	11/09/1999	0.01029	10	0.36	1.09	2.38	
50	11/17/1999	0.01353	14	0.94	1.09	2.38	
50	11/23/1999	0.01008	10	0.44	1.04	2.38	1.08
50	12/01/1999	0.00777	8	0.38	0.97	2.38	
50	12/09/1999	0.00968	10	0.71	0.96	2.38	
50	12/17/1999	0.00900	9	0.37	0.93	2.38	
50	12/21/1999	0.01310	13	0.58	0.92	2.38	
50	12/29/1999	0.01061	11	0.57	0.89	2.38	0.93
50	01/04/2000	0.00571	6	0.24	0.86	2.38	
50	01/12/2000	0.00964	10	0.76	0.85	2.38	
50	01/20/2000	0.01096	11	0.89	0.80	2.38	
50	01/25/2000	0.00831	8	1.81	0.82	2.38	0.83
50	02/02/2000	0.00313	3	0.39	0.78	2.38	
50	02/10/2000	0.01941	19	1.96	0.80	2.38	
50	02/15/2000	0.01469	15	2.62	0.82	2.38	
50	02/23/2000	0.01089	11	1.72	0.81	2.38	0.80
50	03/02/2000	0.00858	9	1.24	0.82	2.38	
50	03/09/2000	0.01586	16	1.94	0.83	2.38	
50	03/14/2000	0.01086	11	0.74	0.83	2.38	
50	03/22/2000	0.01258	13	0.84	0.82	2.38	
50	03/30/2000	0.01183	12	0.54	0.81	2.38	0.82
50	04/04/2000	0.01304	13	0.55	0.80	2.38	
50	04/12/2000	0.01290	13	0.64	0.80	2.38	
50	04/20/2000	0.01280	13	0.67	0.80	2.38	
50	04/25/2000	0.00797	8	0.31	0.80	2.38	0.80
50	05/02/2000	0.00703	7	0.39	0.79	2.38	
50	05/10/2000	0.00580	6	0.39	0.79	2.38	
50	05/18/2000	0.01005	10	0.57	0.79	2.38	
50	05/23/2000	0.00763	8	0.34	0.78	2.38	
50	05/31/2000	0.02420	24	1.47	0.79	2.38	0.79
50	06/06/2000	0.01850	19	0.55	0.79	2.38	

50	06/14/2000	0.00690	7	0.25	0.78	2.38	
50	06/22/2000	0.00844	8	0.27	0.78	2.38	
50	06/30/2000	0.00435	4	0.10	0.77	2.38	0.78
50	07/06/2000	0.00708	7	0.22	0.76	2.38	
50	07/14/2000	0.00480	5	0.24	0.74	2.38	
50	07/18/2000	0.00380	4	0.08	0.73	2.38	
50	07/26/2000	0.00347	3	0.09	0.73	2.38	0.75
50	08/03/2000	0.00342	3	0.19	0.72	2.38	
50	08/11/2000	0.00296	3	0.10	0.70	2.38	
50	08/15/2000	0.00443	4	0.21	0.69	2.38	
50	08/23/2000	0.01100	11	0.50	0.68	2.38	
50	08/31/2000	0.00293	3	0.14	0.67	2.38	0.69
50	09/06/2000	0.00348	3	0.17	0.66	2.38	
50	09/12/2000	0.00700	7	0.22	0.65	2.38	
50	09/20/2000	0.00293	3	0.15	0.63	2.38	
50	09/28/2000	0.00469	5	0.23	0.62	2.38	0.65
50	10/03/2000	0.00502	5	0.20	0.61	2.38	
50	10/11/2000	0.00748	7	0.35	0.61	2.38	
50	10/19/2000	0.01150	12	0.18	0.59	2.38	
50	10/24/2000	0.01010	10	0.25	0.58	2.38	0.60
# Data Pts.	**290**						
Mean		**0.01857**	**19**	**1.02743**	**1.12290**		**1.11262**
Std Dev.		**0.01005**	**10**				
M+3SD		**0.04874**	**49**				
	MAX.		49	4.38	1.70		
	MIN.		2	0.08	0.58		